REMARKS

Claims 1, 3-16, 18 and 19 are pending in the present application. Claims 16, 18 and 19 are withdrawn from consideration.

Information Disclosure Statement

The Office Action indicates that EP 0885650 and EP 1004347 listed and submitted with the Information Disclosure Statement of June 15, 2006, were not considered because translations were not provided.

Applicants respectfully submit that a translation is not required and that the references should at least be considered "insofar as it is understood on its face." MPEP § 609.05(b). Furthermore, the requirement for a "concise explanation of the relevance" of non-English documents "can be satisfied by submitting an English-language version of the search report or action which indicates the degree of relevance found by the foreign office." MPEP § 609.04(b). A copy of the International Search Report (in English) was submitted with the IDS.

Regarding the International Search Report also submitted with the IDS, the Office Action indicates that it is an "invalid form of literature." However, Applicants note that the International Search Report complies with both the content requirements of 37 C.F.R. § 1.98 (English version of the international search report was submitted) and the time of filing requirements of 37 C.F.R. § 1.97, and thus, the international search report should be considered. MPEP § 609.05(b).

Applicants request consideration of EP 0885650, EP 1004347 and the International Search Report, and acknowledgement of consideration of the references. A copy of the IDS is attached for convenience.

Claim Rejections – 35 U.S.C. § 103

Claims 1, 3-9 and 11-15 were rejected under 35 U.S.C. § 103(a) as being unpatentable over **Wu** (US 5,898,014) in view of **Yagi** (US 6,376,423); and claim 10 was rejected under 35 U.S.C. § 103(a) as being unpatentable over **Wu** and **Yagi** as applied to claims 1, 8 and 9, and further in view of **Allison** (US 2002/0115730).

Favorable reconsideration is requested.

The catalyst of the present invention as recited in claim 1 shows a high conversion rate, a high H_2 selectivity, a high CO selectivity and an improved resistance against carbon deposition, which are essential and critical properties of catalyst for catalytic partial oxidation ("CPOX") of lower hydrocarbons to obtain synthesis gas which is useful as a staring material for chemical synthesis.

Wu discloses a three-way conversion ("TWC") catalyst for automobile exhaust gas treatment. Such a catalyst is used to perform complete oxidation of unburned hydrocarbons and CO, simultaneously with reduction of nitrogen oxides (NOx) to N_2. Usually, air and fuel (gasoline) are supplied to an automobile engine generally at a theoretical mixing ratio for complete combustion (*i.e.* 14.7). Therefore, substantially no (or a very low level of) oxygen is present in automobile exhaust gas, while a few percent of CO, 0.04-0.10% of unburned hydrocarbons, and thousands of ppm of NOx are contained in such exhaust gas.

Therefore, the TWC catalyst to be used for automobile exhaust gas treatment must have a capability of performing complete oxidation of CO and unburned hydrocarbons to CO_2 and H_2O under conditions of a very low level of oxygen. Due to this, the TWC catalyst contains a catalytic metal showing a strong oxidation activity (*e.g.*, Pt or Pd). Furthermore, assuming oxygen shortage possibly occurring depending on the operating conditions of an automobile engine, a material having an oxygen storage capacity (*e.g.*, CeO_2) is used in the carrier of the TWC catalyst for ensuring complete oxidation.

In contrast, catalytic partial oxidation ("CPOX") is performed by conducting incomplete combustion of hydrocarbons (*e.g.*, CH_4) on a catalyst to obtain synthesis gas (*i.e.*, $CH_4 + 0.5O_2 \rightarrow CO + 2H_2$). In the CPOX process, feedstock gas supplied to a catalyst bed contains 0.5 mole of oxygen relative to 1 mole of carbon atom (in hydrocarbon molecules). Thus, feed stock gas for the CPOX process contains a much higher level of oxygen as compared to automobile exhaust gas. Therefore, the catalyst to be used in the CPOX process is required to show a high selectivity, enough for allowing only the progress of partial oxidation while suppressing complete oxidation of hydrocarbons in the atmosphere containing a substantial amount of oxygen. In addition, in the CPOX process, neither Pt nor Pd is preferably used as a catalytic metal because their oxidation activities are too high, and a material having oxygen storage capacity (*e.g.*, CeO_2) is not contained in the catalyst carrier at an excessively high amount.

Furthermore, the CPOX catalyst is exposed to an atmosphere of feedstock gas or produced synthesis gas under conditions of high temperature (200 to 1200°C) and high pressure (0.5 to 5 MPa), which easily causes carbon deposition, while the TWC catalyst is used in an

atmosphere which does not cause significant carbon deposition. Therefore, the CPOX catalyst should not contain a metal (*e.g.*, Ni and Fe) or a carrier material (*e.g.*, alumina) which possibly promotes carbon deposition, while the TWC catalyst is not subject to such restriction.

As seen from the above, required properties for the TWC catalyst (for complete oxidation) and those for the CPOX catalyst (for partial oxidation) are quite different from each other.

(1) Applicants respectfully submit that Wu in view of Yagi does not teach or suggest:

> a catalyst for manufacturing synthesis gas containing carbon monoxide and hydrogen as principal ingredients from feedstock gas containing hydrocarbon having 1 to 5 carbon atoms in each molecule and oxygen

as recited in claim 1, and that this feature would not have been obvious.

The Office Action acknowledges that Wu does not disclose a catalyst for manufacturing synthesis gas. (Office Action, page 4.) The Office Action takes the position that the limitation is an intended use of the composition, and thus, does not have patentable weight, (Office Action, page 4), and that the composition of Wu can be used for the oxidation of hydrocarbons, and thus one of ordinary skill in the art would appreciate that a catalyst that can be used for oxidation, can also be used for partial oxidation. (Office Action, page 5.)

Even if the limitation is considered "an intended use limitation," the limitation can be distinguished from the prior art if the prior art is not capable of performing the intended use.

Applicants respectfully submit that the catalyst in Wu is not capable of use for partial oxidation and is not capable of manufacturing synthesis gas as recited in claim 1.

The TWC catalyst composition of Wu comprises a precious metal component, a support carrying the precious metal component thereon, and an oxygen storage composition composed of a zirconium component, a cerium component, a neodymium component and a praseodymium component (claim 6). The catalyst composition may contain an alkaline earth metal component such as magnesia (claims 16 and 17). The support is made of a material selected from silica, alumina and titania compounds (claim 7), preferably activated alumina (claim 9).

Applicants note that the use of alumina should not be used as a material of the CPOX catalyst. Comparative Example 16 of the present application demonstrates that when alumina was used, the carbon amount of the catalyst was increased by 0.099% by weight, which is a much higher increase of carbon amount as compared to the results of Examples 1 through 6 of the subject application (0.002 to 0.006% by weight). (*See, e.g.*, specification, page 28 and Table 1.)

Wu also discloses the use of neodymium component (neodymium oxide) and the praseodymium component (praseodymium oxide) which act as reaction promoters. (Col. 11, lines 23-29.) The reaction promoters promote catalytic conversion of CO and H_2 to CO_2 and H_2O, respectively. (Col. 11, lines 29-34). In view of this, the TWC catalyst of Wu is suitable for oxidation of CO and H_2. Wu states that the catalysts are useful in promoting the oxidation of hydrocarbons, oxygen-containing organic components and CO, as well as the reduction of nitrogen oxides. (Col. 15, lines 20-23). Wu also states that the catalytic composition can advantageously be used for removal from gaseous exhaust effluents uncombusted or partially combusted carbonaceous fuel components. (Col. 15, lines 7-12). Thus, Wu discloses a catalyst

for causing complete oxidation of carbonaceous materials. To one of ordinary skill in the art, the catalyst in Wu cannot be used for partial oxidation of hydrocarbons under high temperature and high pressure for manufacturing synthesis gas.

(2) Applicants respectfully submit that the specification of the present invention demonstrates unexpectedly improved results over the prior art, and thus, the claims of the present invention would not have been obvious.

Example 1 of Wu describes the manufacture of a catalytic composition comprising 28% by weight of CeO_2, 7% by weight of Pr_6O_{11}, 7% by weight of Nd_2O_3 and 58% by weight of ZrO_2. The weight ratio of ZrO_2 to the lanthanoids (CeO_2 + Pr_6O_{11} + Nd_2O_3) of this composition is comparable to the catalyst of Comparative Example 15 of the subject application comprising 50% by weight of ZrO_2 and 50% by weight of CeO_2. The catalyst of Comparative Example 15 shows a CH_4 conversion rate of 65.2%, a H_2 selectivity of 84.5% and a CO selectivity of 90.0%, which are lower than those of Examples 1 through 6 showing a CH_4 conversion rate of 78.8 to 80.0%, a H_2 selectivity of 90.2 to 91.2% and a CO selectivity of 90.7 to 91.5%. This result is apparently caused by oxidation of H_2 and CO, which are the final products of the CPOX process, due to high oxidation activity of the catalyst.

Moreover, the catalyst of Comparative Example 4 of the subject application (15% by weight of MgO, 70% by weight of ZrO_2 and 15% by weight of CeO_2) corresponds to a catalyst which is modified from the catalyst of Example 1 of Wu by adding a small amount of MgO, and thus, is modified as asserted by the Office Action in view of Yagi. The catalyst of Comparative Example 4 shows a CH_4 conversion rate of 74.4% and an H_2 selectivity of 86.2%, which are

lower than those of Examples 1 through 6. The carbon increase of the catalyst of Comparative Example 4 is 0.053% by weight, which is higher than 0.002 to 0.006% by weight of the catalysts of Examples 1 through 6.

As seen above, the catalyst of the present invention shows a higher CH_4 conversion rate, a higher H_2 selectivity and a higher CO selectivity as well as an improved resistance against carbon deposition. These properties are highly desirable as a CPOX catalyst and are unexpectedly improved results over the catalyst in Wu and Wu in view Yagi.

For at least the foregoing reasons, claim 1 is patentable over the cited references, and claims 3-15 are patentable by virtue of their dependence from claim 1. Accordingly, withdrawal of the rejection of claims 1 and 3-15 is hereby solicited.

In view of the above remarks, Applicants submit that the claims are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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Attachment: Copy of Information Disclosure Statement dated June 15, 2006